

PROBLEMS OF SAFETY AND RISK IN PHYSICAL EDUCATIONPodstawski Robert¹, Zwolińska Danuta², Nowosielska-Swadźba Danuta²¹ Department of Physical Education & Sport, University of Warmia & Mazury in Olsztyn, Poland² The Institute of Physical Culture, State Higher Vocational School in Racibórz, Poland

Abstract. *Purpose:* One of the methodology issues in Physical Education is providing children with safety. The purpose of this work is to present basic concepts of safety at Physical Education classes. *Material & Methods:* The issues connected with safety at classes of Physical Education have been discussed in the subsections, each of which focuses on different concepts such as: legal safety regulations, causes of hazards, theoretical models of preventing hazards at P.E. classes, nutrition programs related to exercise's fulfillment, prevention of heat disorders and dehydration. *Results:* According to experts' opinion, the causes of safety hazards at P.E. classes can be divided into three groups: caused by instructor, caused by a student, and finally hazards technical in nature. The number of accidents during P.E. classes is still substantial, and among most common hazards there are the following: fractures of upper and lower limbs, dislocations, contusions, tendonitis, muscle tear and cuts. Curiously, boys experience such injuries more frequently than girls. *Conclusions:* Even though safety rules at Physical Education classes are defined by specific regulations, children's absolute safety is never guaranteed. In order to diminish the number of misadventures, instructor is obliged not only to adhere to the norms but also to teach children to safety rules.

Key words: physical education, children, safety, risk, preventive measures.

Introduction

Safety of children and adolescents during school sports activities is the key issue in methodology of Physical Education (PE). For this reason, safety should be the subject of primary concern while planning PE activities [10]. Apart from basic safety rules and regulations observed in the school at PE, each physical activity (PA) has its own set of safety rules, with which all students should familiarize themselves [15]. Notwithstanding the rules, education and care, which more often than not minimize the occurrence of safety hazards, injuries, incurred during PE classes, are hard to be avoided. [50]. In the opinion of some sports instructors, misadventures are inevitable while performing physical activities as they are inherent part of movement, therefore anyone who is physically active should be aware of such risk.

Adequate safety control during classes of PE should be particularly addressed to primary school pupils [9, 28], physically [20, 36, 51] and mentally handicapped [3, 49]. Interestingly, the number of the physically handicapped is continuously growing, especially in the highly developed countries [24] as well as in many developing countries including Poland [38]. To illustrate this, the percentage of the overweight and the obese marked with a relatively low level of physical fitness (PF) is on the increase all over the world [2, 48, 57, 64]. Thus, at present such people are more frequently regarded as physically disabled or handicapped. In view of this fact, PE teachers are expected to be not only knowledgeable about their subject, but also display the proper sensitivity towards their students' size and body weight. Negative expectations towards obese students, expressed by teachers, may undermine or neutralize the effectiveness of actions, aimed at reducing overweight and obesity of children and young people [42]. First Lady Michelle Obama announced in her intentional letter that treatment of complications directly related to overweight and obesity amounts annually to the expense of 150 billion dollars [47].

Traumas and injuries incurred as a result of accidents make children unhealthy, that consequently hinders their development. Government administration must provide huge financial means for post accidental treatment. For instance, in Australia the expenses connected with post traumatic treatment exceeded 4 billion dollars in 2001 and 2002 [7]. In the USA, on the other hand, from 1991 to 1996 there were between 20,940 to 26,120 injuries caused as a result of strength training performed by young people under 21 [46]. As a result, the issues of traumatism also pertain to the child's motor development, which is closely related to the individual pace of learning and permanent acquisition of new motor skills (as a component of motor fitness) [59].

The purpose of this work is to raise awareness of safety issues at classes of Physical Education, and to stress on the importance of education in these aspects, in broad sense of this word.

Materials and Methods

Gathering literature: In order to gather adequate information on safety rules at classes of physical education, the authors used both private and public resources of Polish and foreign literature. The literary content of this work was also taken from the electronic databases which refer to the articles on the subject of safety at PE classes, published up to 2015. So as to obtain them, the following entries were applied: 'safety', 'children', 'physical education', and 'traumas and injuries' in the databases such as: EBSCO, DOAJ, PUB MED, and SCOPUS. As the overwhelming majority of works focused on methodology-related issues, the penetration of the literature was extended into the information stored in the specific websites.

Presentation of the data: The problems of safety at classes of Physical Education have been arranged in subsections, each of which focuses on different concepts such as: safety rules and regulations, the causes of hazards at P.E. classes (caused by teacher, caused by a student, and finally hazards technical by nature), theoretical models of hazards' prevention at P.E. classes, nutrition programs related to exercise, prevention of heat disorders and dehydration.

Definition of safety: *Safety is the state of being "safe" (from French "sauf"), the condition of being protected against physical, social, spiritual, financial, political, emotional, occupational, psychological, educational or other types or consequences of failure, damage, error, accidents, harm or any other event which could be considered non-desirable. Safety can also be defined to be the control of recognized hazards to achieve an acceptable level of risk. This can take the form of being protected from the event or from exposure to something that causes health or economical losses. It can include protection of people or of possessions [69].*

Definition of physical activity: *in the present work physical activity is defined as any body movement, produced by skeletal muscles, that results in energy expenditure. The energy expenditure can be measured in kilocalories. Physical activity in daily life can be categorized into occupational, sports, conditioning, household, or other activities [17].*

Definition of physical education: *physical education is integral part of educational system being a fundament of physical culture, which should satisfy real-time needs of children and adolescents in terms of their physical and mental development. Hence, this concept refers to the process, throughout which young people are educated how to take care of their physical fitness, once the course of their formal education is over (definition suggested by Podstawski based on: Grabowski [23].*

Results

1. Rules and regulations

Safety rules at classes of PE are regulated by the relevant legal acts which are in force in a given country (in Poland, among others, Ministry of National Education and Sport dated from 31st December 2002 on safety and hygiene in public and private schools and institutions). According to The Polish Teachers' Charter (The School Teachers' Document on Pays and Conditions) „*the teacher is required to reliably perform tasks related to his/her post and the basic functions of the school such as teaching, educating and caregiving, including tasks related to the safety of students during activities organized by the school (...)*” [55]. In order to reduce the number of health hazards among children and adolescents, a variety of preventive measures are used, which in Poland, for instance, are developed and implemented by the relevant departments of the Ministry of National Education and Sports, as well as by direct supervision of schools [54].

Despite all the regulations and instructions on proper management of PE classes at schools, there is still a substantial number of accidents which take place at PE classes. The most common injuries are the following: fractures of upper and lower limbs, dislocations, contusions, tendonitis, muscle tear and cuts. Curiously, boys experience such injuries more frequently than girls [62].

2. The causes of hazards at classes of Physical Education.

The causes of hazards stem mainly from the fact that children and adolescents are unaware of the consequences of their own behavior, which frequently poses threat to their health or life. In opinion of Mazur and Wojnarowska [44], one of the reasons for this status quo is promotion of safety, oriented on the environment rather than on young people's lifestyle. One should also bear in mind that movement acts vary in terms of difficulty, which is the case not only in professional sport but also in school PE. This aspect is growing in significance due to the scientifically proved phenomenon of hypokinesia i.e. PA for which human body is programmed [27]. As a result of the sedentary lifestyle, people are becoming weaker in terms of their physical fitness, which consequently lowers the level of their motor skills and abilities such as speed, strength, endurance, coordination and flexibility [18, 58]. According to Olszowski [50], there are three causes of safety hazards in daily school practice:

- A) caused by teacher,
- B) caused by a student,
- C) technical by nature.

Ad. A). Causes of safety hazards, caused by the teacher

Credentials and qualifications

As it is indicated by Calderhead [14] *PE teacher ought to have background knowledge in sport sciences and in the human movement sports studies of physical education. According to this study teaching P. E. can be an extremely difficult job, both physically and mentally, as 'there are many different roles and levels of responsibility to consider each day. Classes of Physical Education can be conducted by a person skilled in the subject, who meets the requirements, specified in regulations issued by the government [30]. Apart from adequate qualifications in physical culture, PE teachers must be trained to first aid, the quality of which frequently affects the extent of post accidents complications and the pace of recovery [12]. Even in case of very serious accidents or injuries, the chances for survival significantly increase, if eye-witness is skilled in first aid [19]. For this reason, each PE teachers' staffroom should have a properly equipped first aid kit, the content of which is clearly indicated in the list of items including instructions for the use [62].*

Badly-organized classes

This is unquestionably the weakest link of teacher's workshop, irrespective to his/her experience and career span, which is frequently connected with so-called stuck-in-the-rut approach to the classes. It is necessary to attract attention to the fact that students' safety should be guaranteed since the moment they arrive at the lesson (e.g. on their way to the swimming pool), or while they are getting ready for the classes in the changing room, or on their way to the gym or pitch [50]. It is also crucial that the teacher in charge is imaginative enough to predict the consequences of the students' behavior. Prior to the classes, the teacher should instruct students on safety rules, which are the part of methodology. He/she should gradually increase difficulty of exercises and provide assistance while performing more difficult tasks. An accident might happen as a result of teacher's delayed response to the hazardous situations, in which students find themselves. Children must be aware of safety of the tasks that they perform. Accidents might occur under the following circumstances: student is afraid of performing the task, refuses to follow teacher's instructions and suggestions, has no idea of movement and how to acquire it, has no adequate body posture while performing exercises, has ill comprehension of how to place movement in time, has no proper warm-up, inadequately holds sport gear, is insufficiently prepared to perform some tasks [50].

Poorly – planned lesson framework (ill methods of work) Uninteresting and badly-organized classes can cause too much chaos and disorder (badly-managed use of equipment) and can make students overactive. It should be borne in mind that each P.E. class or a training session consists of 3 parts: initial, main and final. In consequence, it is expected that student would go through an effective warm-up, then focus at the maximum during main part, and cool down properly during the final part [21]. The number of organizational and cleaning activities should be reduced to the minimum so as to devote the bulk of the time to motor activities. However, this stage might be effectively managed by presenting the roles of both teachers (trainers) and students during classes of PE [4]. It is necessary to discuss the code of conduct at PE classes, especially with the primary school pupils [30]. Finally, it is highly unacceptable to leave children unguarded during training session.

Lack of discipline and order

Discipline and order are essential elements in preventing from hazards, particularly while performing motor activities such as: gymnastics, martial arts (judo, karate) and swimming [66]. Lack of elementary discipline is often a cause of accidents, since the students, who start the classes without disciplining exercises (issued by means of commands), behave in a very flippant and disruptive way [45]. Teacher should create such supportive environment so that the students' emotional and physical needs are satisfied [31]. During the properly conducted classes every stage of the lesson is in perfect order. Classes, which are well-prepared and thought-over not only increase students' safety but also increase the pace of acquiring motor skills and abilities. Teacher is responsible for presenting not only the objectives of the classes but also health and safety rules in force in the classroom. Ill-planned and inadequately organized classes, which provide no safety of the place (running start, landing), gear and equipment (box, vaulting horse), often result in serious injuries [63].

Failure to comply with the applicable rules

It refers to the organization and conduct of the classes itself; also to the participation of the students, teacher's instructions on the use gear and the quality of gear, facilities, sports equipment; rules for the use of facilities, spatial devices (rules for the use of judo mats, gym, swimming pool etc.). To illustrate this, wrong arrangement of goals or floating baskets in the swimming pool may cause difficulty to participants of game while getting into and out of water.

Poor awareness of students' psychomotor abilities

This drawback is particularly discernible, when teacher deals with overcrowded groups of mixed motor fitness students [50].

Ad. B. The causes of accidents resulting from the student's personality

Experiencing injuries and traumas is quite a frequent occurrence during the school days [6]. Classes of PE should result in the child's proper psychomotor development. At PE classes student can manifest natural tendency to movement as such, to be very impulsive, unpredictable, and insufficiently imaginative so as to avoid safety risks. Moreover, as numerous research works have proved, participating in sports competition and selected forms of PE increases aggressive behavior of children and adolescents [25, 37, 41], yet this is strongly correlated with the type of PA, student's age and sex [8]. Apart from specialist's knowledge, teacher of PE should be able to predict potential hazards, should be exceptionally observant and have very good rapport with children. Such approach may prevent accidents which happen as a result of the following situations: the lesson is not preceded by a warm-up [35], students are in the state of emotional turmoil or apprehensive of the task they are about to perform, they are suffering from fatigue or/and exhaustion, they lead unhealthy lifestyle, they overestimate their abilities, they have insufficient knowledge of safety rules or another student's assistance, they experience unfriendliness on behalf of other students, they have domestic troubles.

Personal problems

It is not advisable to increase intensity of exercise when child experiences personal or domestic problems; he/she feels unwell, unhappy or is recovering from illness. Excessive excitement also poses risk of breaking safety rules, as the child wants to practise without protection, overestimating his/her physical abilities. It is usually expected that a warm-up shortens the time, necessary to adjust the body to optimal effort. It should also improve the effectiveness of respiratory system and circulation, and enhance the performance of nerve processes [40]. Anxiety, on the other hand,

stiffens the child's movements, making him/her unable to fully concentrate on the task and preventing him/her from evaluating the situation objectively. In order to prepare a child to face difficult, dangerous or frightening situations, it is necessary to develop comprehensive motor fitness of a child and to teach him/her about destructive consequences of negative thinking. The research showed that there is a strong feedback between child's sense of security and motor effects of his/her motor training [11]. What is more, physically fit children find it easier to assimilate in a peer group, and have fewer problems undertaking new roles, fulfilling tasks and instructions which are part of students' charter of rights and duties [26, 52].

When exposed to difficult or/and dangerous tasks, a physically fit person reacts anxiously as well, yet he/she finds it much easier to put up the defenses. Therefore it seems to be pointless to try to avoid challenges during classes of PE as it seems to be the sheer joy of overcoming one's limits that makes these classes so enjoyable. That's why, while realizing program, which involves more difficult motor tasks, the students' attention dwindles as a result of fatigue. As a result, they start to make more mistakes, which, in turn, may cause accidents [29].

Unhealthy lifestyle

By this we mean numerous factors which affect one's health and physical fitness, including malnutrition and bad eating habits. In this case, it is recommended to educate students to effects of appropriate nutrition and physical fitness on the proper functioning of the body. Recently, malnutrition has been also correlated with poverty caused by unemployment. Another issue is imbalance between work and leisure, as a result of which child ends up being overloaded with tasks at school and additional homework assignments at home. Security rules should be taught before each difficult task. Children, who are familiar with such rules, easily overcome fear, better comprehend the situation and faster learn specific motor tasks.

Ad. C. Causes of accidents, which are technical by nature

The causes of accidents, which are technical by nature, can be the following: inadequately prepared sports facilities, slippery and wet surface, insufficient gear and sports outfit, poor condition of the running start and take-off area (wrong board), bad state of track, uneven surface of the track, ill-fitting shoes and clothes, uncertified sports equipment, absence of basic safety rules knowledge concerning using the equipment, unreasonable choice of places for the purpose of sports activities, negligence of the traffic code. Material base and teaching aids are other factors which significantly affect the performance of P.E. classes and warrant security while conducting the classes. According to Ostrowska [53] the following places may pose threats to the students' safety:

- concrete or stone residues in the area immediately adjacent to the pitches, which in the light of the rules for team sports games disturb free security zone along the side and final lines of the pitch. Hypothetical hazards may include internal injuries or fractures incurred as a result of the student colliding with such objects,
- uneven (pre-bulldozed) surface of the pitch. Hypothetical hazards include ankle injuries, fractures of lower as well as upper limbs as a result of propping the body while falling, scratches and, in consequence, likelihood of infections,
- inadequate technical standards of athletic complexes e.g. faulty material of the board, unmarked and too high curbs, or the width of the long jump run smaller than 1,22 m. Hypothetical injuries include dislocations and fractures of lower limbs as well as pelvis injuries as a result of the slipping on the board or tripping over the curb,
- improper design and inadequate arrangement of the pitches being part of the sports complexes e.g. volleyball courts situated in the immediate proximity to the tennis courts, without any barrier. A hypothetical incident: a student playing volleyball invades the tennis court and having been hit with a tennis ball loses his sight and suffers from contusions,
- incomplete casing of the radiators placed along the wall lined with gym ladders. Hypothetical hazards include damage to the skin and soft tissue as a result of direct contact with the object or jamming of the feet between the ladder and the radiator.

Recently, 'sport simulators' have become quite popular in school environment. They are devices or groups of devices (e.g. atlas) which provide: specific conditions for the muscle workout, objective measurement of the specified motor parameters (e.g. *online*), and the possibility to program and adjust motor tasks [67]. Due to the fact that exercises on simulator may involve relatively big number of students, they should become commonplace while teaching PE to children and adolescents [68]. Each device of this kind should have instructions for use as well as attached safety rules, which shall be clearly demonstrated to students. This particularly refers to restrictions on the minimal age of users, for instance of electric treadmill. While operating this equipment, discharge of electrostatic force can occur and the device will be switched off. It is highly unacceptable to allow small children to enter such devices being unprotected. Teacher in charge of the classes should thoroughly present the technique of exercising on every single component of the device and explain to the students the purpose of each exercise.

2. Eating habits while performing physical activity

It is a widespread belief in our society that some sports drinks and their ingredients possess miraculous powers. To prove this, there appears more and more people in sport-recreational facilities, gyms and fitness clubs, who resort to supplements (e.g. isotonic liquids, energizing bars, fruit juices or mineral water) while practicing sport [13]. Such a tendency is also observed among school students, who bring various supplements to school so as to consume them during

the classes of PE. While analyzing the issues of safety at classes of PE in terms of proper nutrition, it should be highlighted that during the PA human body is more focused on energy outlet rather than intake [70]. Therefore, it is not always justified to consume an excessive amount of supplements while doing exercise, especially when the average time of physical effort rarely exceeds 45 minutes [43].

Analyzing the issue in terms of safety, it is necessary to refer to the basic rules of nutrition at physical training. First of all, larger portions of food such as breakfasts or lunches should be consumed 2-3 hours before training session or competitions. Eating directly before exercise can result in such negative reactions as vomiting or stomachache [33]. If exercise is scheduled for the morning, it is unadvisable to have heavy breakfast. Such food is left over in stomach, which significantly diminishes a person's motor abilities (by limiting ability of absorbing oxygen). In such case, it is strongly recommended to consume a small breakfast rich in carbohydrates (6,9%) or drink a solution of carbohydrates and electrolytes e.g. diluted fruit juice in the ratio 1:2, bearing in mind that gastric juices start to be produced no sooner than 1,5 h after waking up [56].

Preventing heat disorders and dehydration during physical activities

Regular fluid replacement prevents dehydration of the body through sweat [22]. Sweating appears due to activation of thermoregulatory mechanisms, by which heat is dissipated to the environment and organism maintains a constant body temperature (approx. 37 ° C). Increase of body temperature by 3°C above the norm causes impairment of physical and mental functions. Further rise of body temperature may result in serious health disorders (heat illness, muscle cramps, heat syncope or heat strokes), and when body temperature exceeds 42°C – even death [5]. During sports exercise sweat glands secrete between 1-2 l of sweat per hour, and the evaporation of 1 ml of sweat eliminates approx. 2,5 kJ of heat [39]. As a result, during intense physical exercise, the internal temperature of the body without thermoregulation increased at the rate of 1°C per each 5-7 minutes [65].

While performing an intensive physical training, it is advisable to take 7-10 g of carbohydrates per each 1 kg of the body mass every 24 hours (60-70% of the total energy contained in food). During long-term efforts, especially at high temperatures, it is recommended to drink beverages which contain 4-8% of carbohydrates and electrolytes [32]. It is common practice to take fluids every 15-20 min in the amount of 200-250 ml. Children, whose body weight is less than 40 kg, should drink 7 ml of fluid (e.g. mineral water) per each kilo of their body mass every 15-20 minutes. However, in the case of physical efforts, which last longer than 1 hour, it is more beneficial to drink sport isotonic drinks [65]. Right after an exhaustive workout it is recommended to consume easily assimilated fluid carbohydrates so as to accelerate the recovery of glycogen in the muscles and liver [34].

Discussion

The issue of safety is so large that may bring together numerous factors ranging from those technical by nature to those referring to the psyche of child. In order to minimize risks, it is extremely important and urgent to establish 'theoretical models of how to prevent accidents', which would be aimed not only at the need in prevention but also at promotion of safety among students [54]. This is especially true in case of serious accidents, which lead to disability or even death.

One of the fundamental safeguards is insurance from accidents, which solves nothing but can be some kind of protection for the future. Despite the fact that students are insured by the insurance company, it is necessary to carefully check on how much their insurance policy is worth and to what accidents and injuries it applies. It may happen that in spite of disability, a person has failed to obtain full compensation because this type of injury was not specified in the insurance policy. In another case, the amount of compensation is in no way relevant to the loss of health due to the low value of the insurance.

Material base and facilities

PE instructor is primarily responsible for proper functioning of sports facilities, gear and equipment [1]. His/her duties involve regular control of the safety and technical condition of the places where the exercises are conducted such as gyms, pitches, running courses etc. The teacher is obliged to check safety of each item of the equipment every time when it is used during the classes. PE teacher can carry out minor maintenance works so as to sustain complete functionality of gym and other facilities; he/she must remove from the gym or pitch any equipment which presents risk to the students; or finally, he/she may decide on the necessity to carry out an overall technical review of school gear and equipment following the approval of the school authorities [60].

Certificates, approvals and guarantees

Sports gear and equipment being part of the gym or pitch should have valid certificates and approvals, which would guarantee proper functioning of all the elements in these places and facilities. The materials, used for production, the way in which all parts were assembled as well as the manner, in which sports equipment was arranged within the facilities, must have no faults or 'weaker links' but must meet the standards of health and safety protection.

Information boards and regulations of the gym, pitch and swimming pool

In every gym or on every pitch as well as in the areas designated for physical exercise and games, it is compulsory to display information boards laying down the rules for safe and proper use of gear and equipment in such places. Additionally, in order to increase safety, other information boards may be put on display laying down the rules

for specific use of gym, school pitch, mats, and other elements of the equipment (e.g. vaulting horse, box, springboard, baskets, ladders, bullets, medicine balls etc.).

Education of students

Despite basic safety rules, which are observed in daily practice of PE, each form of PA has its own set of safety regulations, awareness of which must be constantly raised among children [16]. Thus, issues concerning safety at classes of PE should be presented and implemented throughout the learning process.

Conclusions

1. Although safety rules at classes of PE are defined by specific provisions, they never fully guarantee children's safety.
2. In order to minimize the number of accidents, teacher is expected not only to adhere to the norms but also to educate the students on the subject of safety.

The subject of safety at classes of physical education should be continued, its range being expanded and focused on the specific forms of PA such as swimming, gymnastics, self-defense and tennis, to mention but a few.

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